

Summary of Investigation into Rates of Low Birth Rate and Very Low Birth Rate in

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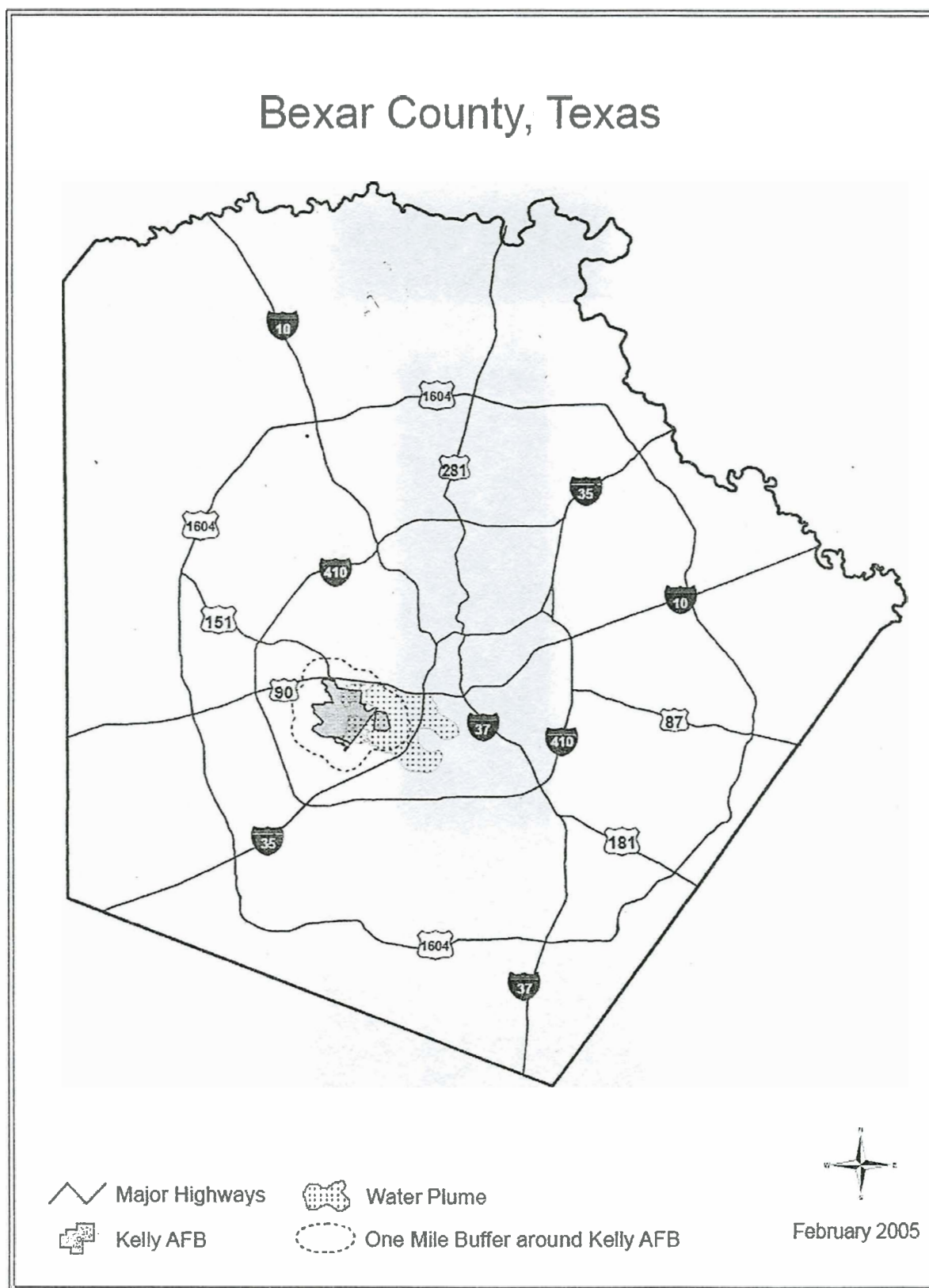
Background

Local residents were concerned about the possible effect of unknown environmental toxins in the vicinity of Kelly AFB in Bexar County, Texas. The Center for Health Statistics Unit of the Texas Department of State Health Services (DSHS) analyzed the percentages of babies born with low birth weight (less than 2500gm) and very low birth weight (less than 1500 gm) over a 13-year period to mothers living in proximity to the base and compared them with the rates for Bexar County as a whole.

Data

Information from birth certificates filed with the DSHS Bureau of Vital Statistics from 1990 to 2002 was analyzed. Spatial proximity to the base was determined by geocoding the mother's residence address, as provided on the birth certificate. A Bexar County birth was originally defined as one with the county reported as Bexar on the birth certificate or with a Bexar county census tract as determined by geocoding. Based on this, a total of 300,843 birth records were included in the study. The birth records included information on the age and race/ethnicity of the mother, as well as the presence (self-reported) of risk factors such as tobacco, alcohol use and inadequate pre-natal care. To analyze the effect of proximity to the base, two variables were defined. The first indicated residence within one mile of the base, the second residence in the Kelly water plume. Figure 1 shows the location of these zones in Bexar County.

Figure 1 - Location of Water Plume and one-mile Buffer – Bexar County



Methods

The data were restricted to those records that were successfully geocoded and were located spatially within the Bexar County line and those without missing birth weight information. This reduced the number of births for analysis to 289,699. The number and rates of births with low or very low birth weight were tabulated for the two proximity variables and compared with the rates for Bexar County as a whole.

Odds ratios, together with their 95% and 99% confidence intervals were computed using logistic regression. The odds ratio is used to compare two sets of binary data. In this case the binary variables are the presence (or not) of low birth weight and the presence (or not) of the proximity variable. An odds ratio of one indicates that there is no significant effect of one set of binary variables on the other. The degree of difference from a value of one indicates the strength of the effect of proximity on low birth rate. A 99% confidence interval for the odds ratio provides an indication of the significance of the result. If the confidence interval includes one, then the result is not significant at the 1% level. This means there is less than a 1% chance that the observed odds ratio could have occurred by chance. The logistic regression procedure also provides the significance level directly.

It is possible that any observed increase in the risk of low birth weight babies with proximity to Kelly is due to a larger number of mothers with known low birth weight risk factors living in the location, rather than the location itself. For this reason a logistic regression model was used to estimate the effects of those risk factors simultaneously with the effect of location.

Spatial analysis methods were also applied to identify areas of low birth weight risks relative to the underlying spatial distribution of births. The tool used was the “Risk-adjusted Nearest Neighbors Hierarchical Clustering” (RNNH) routine in the CrimeStat point-level spatial analysis package.

Results

Tables 1 and 2 summarize the observations. The percentage of low birth weight births is somewhat higher for both the water plume area and the 1-mile proximity, when compared with the whole of Bexar County. There are very few very low birth weight births in the county, but the percentage does appear somewhat higher for the water plume area.

Table 1 - Low Birth Weight Births

Location	Number of low-birth weight births (<2500gm)	Number of live births	Low birth weight rate (Per 100 live births)
Water Plume	1,400	18,535	7.6%
Within 1 mile	1,139	14,746	7.7%
Within Bexar County	21,075	289,699	7.3%

Table 2 - Very Low Birth Weight Births

Location	Number of low-birth weight births (<1500gm)	Number of live births	Very low birth weight rate (Per 100 live births)
Water Plume	273	18,535	1.5%
Within 1 mile	178	14,746	1.2%
Within Bexar County	3,807	289,699	1.3%

Odds Ratios

Tables 3 and 4 show the statistical significance of these observations. All odds ratios are close to one and none are significant at the 1% level, as the 99% confidence intervals show. At the 5% significance level, the odds ratio of 1.071 for the probability of occurrence of low birth weight within one mile of Kelly is the only significant statistic. The test results for very low birth weight reflect the relatively small sample size, so that even though the odds ratio for the water plume area is 1.132, its confidence interval includes one and its significance level is not less than 5%.

Table 3 – Odds Ratios for Low Birth Weight

Location	Odds ratio	Lower 95% CL	Upper 95% CL	Lower 99% CL	Upper 99% CL	Exact Significance
Water Plume	1.044	0.987	1.105	0.970	1.125	0.131
Within 1 mile	1.071	1.006	1.139	0.987	1.162	0.031

Table 4 – Odds Ratios for Very Low Birth Weight

Location	Odds ratio	Lower 95% CL	Upper 95% CL	Lower 99% CL	Upper 99% CL	Exact Significance
Water Plume	1.132	1.000	1.282	0.962	1.333	0.050
Within 1 mile	0.914	0.785	1.063	0.749	1.115	0.242

Logistic Regression Results

Because it is possible that any observed increase in low birth weight rates is due to a larger number of mothers with known risk factors living in the proximity to Kelly rather than to the location itself, a logistic regression model was used to estimate the effect of location, while simultaneously taking into account the presence of other risk factors. The model included the location indicator, the mother's race/ethnicity and age, her self-reported alcohol and tobacco use and the availability of prenatal care in the first trimester. The age factor was represented by a binary variable that indicated whether or not the mother was in the age range of 15 to 39 years. Both one-mile proximity and water plume area were analyzed.

The analysis showed that, at the 1% level, location within one mile of the base was not significant, although there *was* a significant effect at the 5% level. This result is consistent with the odds ratio results. All the other risk factors, with the exception of alcohol use, that were considered had a significant effect at the 1% level. The use of tobacco increased the risk of low birth weight, as did an

age outside of the 15 to 39 range, as well as lack of prenatal care in the first trimester. Black mothers had an increased risk of having a low birth weight baby, compared with Hispanic mothers, while white mothers had a somewhat lower risk. The results for the water plume area were similar, with no significant effect of location, even at the 5% level; this again was consistent with the odds ratios results.

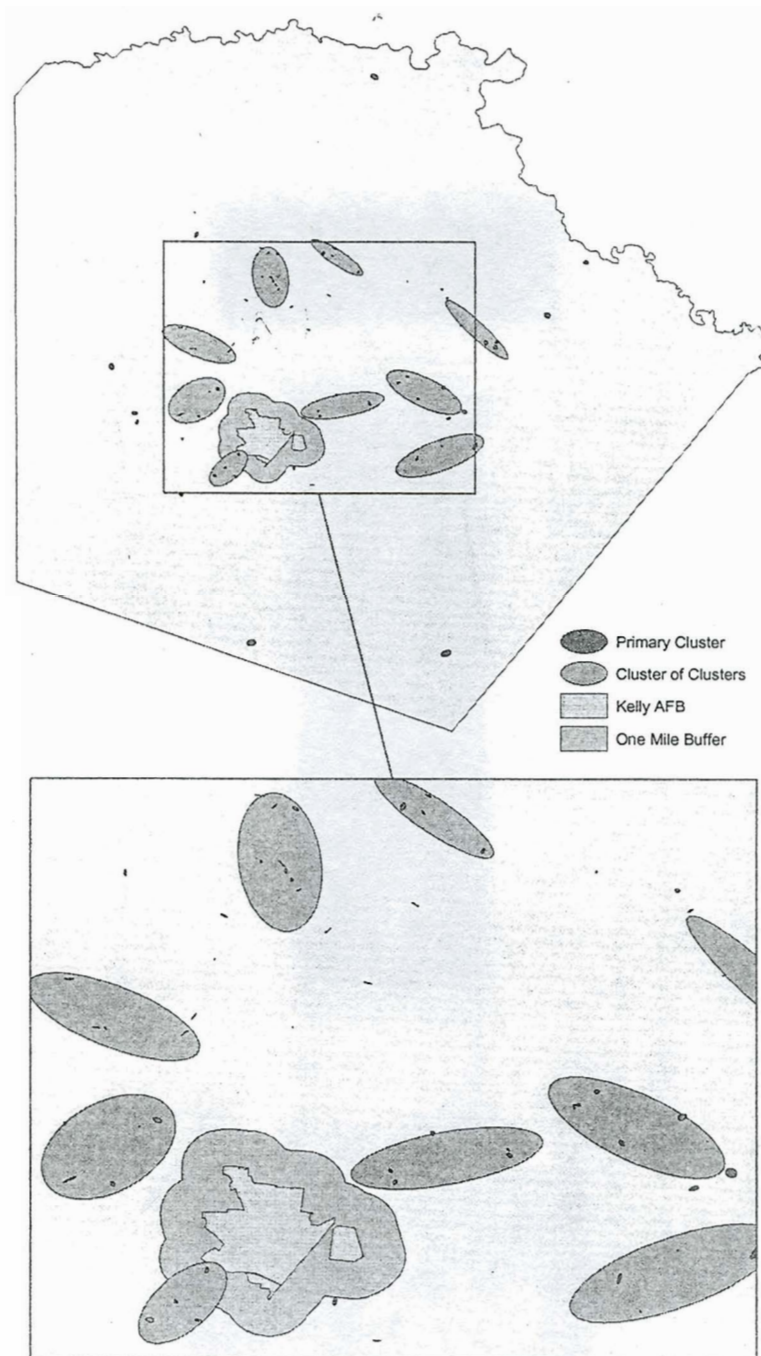
Spatial Analysis Results

In order to better understand the distribution of low-birth-weight babies in Bexar County, a spatial analysis tool to identify areas of high rates relative to the underlying spatial distribution of births was used. The results are shown in Figure 2.

There are several primary clusters and part of a second-order cluster within one mile of Kelly. However, these are just a few of the many clusters in Bexar County. This method accounts for the underlying population but not for the effect of the risk factors discussed above. There may be some spatial clustering of low-birth-weight babies in Bexar County but this does not seem to be uniquely associated with proximity to Kelly AFB.



Figure 2 - Spatial Analysis Results



Conclusions

The incidence of low and very low birth weight births in the region of one mile around the Kelly air force base and in the water plume area was investigated using data from 1990 to 2002, derived from DSHS Vital Statistics records. A total of 289,699 births located spatially within the Bexar County line were analyzed.

The observed small increase in low birth weight births was not statistically significant at the 1% level, using odds ratios derived from logistic regression analysis. When the confounding effects of known risk factors for low birth weight were taken into account, using logistic regression, similar results were obtained.

Spatial analysis indicated that there may be some spatial clustering of low-birth-weight babies in Bexar County but it does not seem to be uniquely associated with proximity to Kelly AFB.